LONG-TERM STORAGE OF ELECTRONIC COMPONENTS AND ASSEMBLIES

DOCUMENT IDENTIFIER: A-SP-ELEN517-00-0 Rev A, 11-Sep-1989

ABSTRACT: This document defines two methods of protecting electronic components and assemblies during storage for extended periods of time (as defined herein).

APPLICABILITY: This document applies to all Digital storage facilities, Digital personnel involved with product storage, suppliers to Digital, and Original Equipment Manufacturers (OEMs) that store Digital products for extended periods of time.

STATUS: APPROVED 11-Sep-1989; type VTX SMC for expiration date.

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Responsible Person: Norm Burke
Original Author: John Lever

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Norm Burke, Industrial Package Engineering

Direct requests for further information to:

Norm Burke

MLO8-3/D17, DTN: 223-3892, BIGPAK::BURKE

John Lever

DLB8/E2, DTN: 291-8766, TOLKIN::LEVER

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1 INTRODUCTION

Due to end-of-life buyouts and requirements for maintaining inventory throughout a product's life cycle, quantities of electronic components or assemblies may need to be stored for extended periods of time.

Unless temperature and humidity conditions are controlled during this storage period, components can degrade to the point where they are no longer functional. The failure mode in most cases is the formation of oxides or corrosion on device leads or contact areas. Ultraviolet (UV) radiation and electrostatic discharge are other causes of product degradation, as is high humidity coupled with corrosive gases (such as smog).

The procedures described herein are designed to control the ambient atmosphere immediately surrounding the product. Such a procedure would be costly and unwieldy in a large chamber or stockroom, but becomes manageable when the environment to which the product is exposed is contained in a sealed, water/vaporproof bag. Through the creation of a dry atmosphere within the bag, the period of time that components/products may be safely stored can be extended.

For protection during long-term storage an average relative humidity of 30 percent (%) Relative Humidity (RH), with a maximum of 40% RH, must be maintained to prevent corrosion. Even though the atmosphere within the storage bag may be within these limits at the time it is sealed, moisture will slowly migrate through the bag walls over extended periods of time. Desiccant is used within the sealed bags to control the level of moisture build-up resulting from this migration.

1.1 PURPOSE

This document defines two procedures for protecting electronic components and assemblies against oxidation and corrosion degradation when stored for extended periods of time. The two procedures are:

a. Dry Nitrogen Flush (see subhead 2.2)

b. Air Evacuation (see subhead 2.3)

Although there are other recognized commercial preservation methods available, it is recommended that either of the above procedures be considered first for Digital products.

1.2 RESPONSIBILITIES

The length of time that these storage procedures provide protection depends on the conditions of storage, primarily temperature, humidity, and resulting dew point within the storage location. The effective protection period may be months or years. It is the responsibility of the owner of the stored product to determine the average dew point for the region, the maximum storage time for the product, the method of protection to be used, and to monitor the effectiveness of product protection throughout the storage period.

1.3 SCOPE

This document describes storage procedures that can be used on a variety of components such as discrete devices, integrated circuits, modules, subassemblies, or completed units.

These procedures were developed for use where products are provided with water/vaporproof protection (such as a barrier bag) and then stored within the immediate storage site. This document does not address shipping of bagged product or test and inspection techniques.

The shipment of barrier protected (bagged) products requires special packaging to protect the storage material from puncture. When a product is shipped at the end of the storage period, it is recommended that the barrier material be removed and the product shipped in conventional packaging that meets local regulations.

1.4 APPLICABILITY

This document applies to all Digital storage facilities or personnel that store moisture sensitive components or assemblies in an uncontrolled environment for periods in excess of three months. An uncontrolled environment is defined as "Class C" in *DEC STD 102-1 Environmental Standard for Computers and Peripherals - Temperature, Humidity, and Altitude Test Requirements*.

This may also include suppliers of product to Digital Equipment Corporation or Original Equipment Manufacturers (OEMs) that purchase product from Digital.

These procedures should be used by the above groups when applicable, but are required for suppliers who have agreed to use the procedure(s) in a Purchase Order and/or special Purchase Specification.

2 PROCESS REQUIREMENTS

2.1 QUALIFICATION

Components or assemblies not otherwise protected or treated that will be stored for a period in excess of three months in a Class C Environment qualify for long-term storage protection.

If product will be exposed to the ambient environments listed below for the designated periods of time or longer, long-term storage procedures should be followed.

	CONDITION	
Storage Time	Temperature	Relative Humidity
Any	Uncontrolled or dew point > 20 C (68 F)	
3 months	27 ± 4 C (80 ± 7 F)	70% RH or higher
6 months	21 ± 2 C (70 ± 4 F)	60% RH or higher

NOTE

Temperature is not as important as humidity; high or changeable humidity levels will cause problems regardless of temperature.

2.2 DRY NITROGEN FLUSH PROCESS

The Material and Technology Analysis Laboratory in Northboro has developed an effective long-term storage Procedure by means of sealing dry nitrogen within a water/vaporproof barrier. The addition of desiccant within the barrier further extends the storage period.

2.2.1 Recommended Materials and Equipment

- MATERIALS
  - **a.** "Richmond" RCAS 3750 barrier bags or an equivalent.

    The RCAS 3750 barrier bag is an aluminum foil bag lined with antistatic polyethylene. The outer layer of the bag is nylon to provide additional tear strength.

    The water vapor transmission rate (WVTR) of these bags is less than .02 grams/100 square inches/24 hours, at 38 C (100 F) 90% RH. WVTR meets the requirements of MIL-B-81705, *Type I Barrier Material, Flexible, Electrostatic-free, Heat-sealable*.

    For a general description of bag material and construction, refer to Digital specification A-PS-1200060-GS, *Barrier Bag, Antistatic, General Specification For*.
  - **b.** Desiccant conforming to MIL-D-3464, *Desiccants, Activated, Bagged, Packaging Use, and Static Dehumidification - Type II, Non-dusting*, in proper amounts based on the surface area of the barrier material and other factors as outlined under heading 3. Refer to Digital specification A-PS-9906086-0-0, *Desiccant* for more information.
  - **c.** Humidity Indicator Card, conforming to MS-20003-2, *Indicator, Humidity, Card, Three-spot Impregnated Areas (Cobaltous Chloride)*. Indicator spots shall be located at 30% RH, 40% RH and 50% RH. Refer to Digital specification A-PS-9908554-0-0, *Indicator, Humidity* for more information.
  - **d.** Digital specification A-PS-3632006-0-0, *Label, Long-Term Storage, ESD*. This label identifies the package as containing desiccant (a method of moisture control) and is used to caution against the chance opening of the bag.
  - **e.** Identification label. Use bar code label A-PS-3628231-0-0, *Label, Direct Thermal* (per EL-CP047-01, *Bar Code Label Print Specification*) when possible.

- EQUIPMENT
  - **a.** Power supply - 120V 60 hertz, single phase
  - **b.** Compressed air - 75 PSI (pounds per square inch)
  - **c.** Impulse sealer, "PAC" Vacuum Bag Sealer Series V. machine, equipped with vent valve per modification LF207861, or an equivalent machine
  - **d.** Nitrogen gas, moisture content < 10 PPM (parts per million)
  - **e.** Two stage nitrogen gas regulator
  - **f.** Work table grounded according to *DEC STD 067-0 Handling of Electrostatic-sensitive Devices - Procedures and Protective Materials*

2.2.2 SPACE REQUIREMENTS

a. Impulse Sealer - 2 feet long x 2 feet wide x 3 feet high

b. Gas Cylinder - 1 foot x 1 foot x 5 feet

c. Bag material storage area - as required

d. Work Table - 2 feet wide x 3 feet long x 3 feet high

e. Work area - approximately 8 feet x 8 feet

2.2.3 IMPULSE SEALER SETUP

Different size barrier bags may be used with the Impulse Sealer (as required by size of product). The following machine settings are approximate and are based on an 8 x 30 inch empty bag. For larger or smaller bags, increase or decrease gas quantity accordingly.

1. Set the source air pressure regulator to 75 PSI.

2. Set the nitrogen source pressure regulator to 30 PSI.

3. Set the sealer low pressure regulator to 25 pounds.

4. Set the sealer high pressure regulator to 60 pounds.

5. Turn the sealer power switch ON.

6. Turn the sealer vacuum pump ON.

7. Turn the Vacuum/Gas switch to the GAS position.

NOTE

If components have sharp points or edges, or are extremely fragile, adjust the vacuum vent valve to increase pressure; this allows for space around component during the sealing operation, minimizing the possibility of bag damage.

8. Turn on the gas timer and set it to 3.0.

9. Turn on the seal timer and set it to 2.5.

10. Set the dwell timer to 5.0.

2.2.4 Customizing Barrier Bag to Fit Product

When a convenient size bag is not available it may be necessary to fabricate a custom bag using flat sheets of MIL-B-81705 from roll stock. The bag should be sized with enough barrier material at the bag edge normally opened for inspection to allow for at least one subsequent seal (approximately 5 inches is required for an additional seal) .

To determine the proper barrier size:

1. Measure the length, width, and height of the item to be bagged.
   a. Length of Barrier Material (LBM)

      LBM = (2 x product width) + (2 x product height) + (3 inches for heat sealing)

      If it is determined that the heat sealed edge will be the same edge used for inspection, add another 2 inches for a future heat seal (total of 5 inches).

   b. Width of Barrier Material (WBM)

      WBM = (product length) + (product height) + (3 inches for heat sealing)

      If it is determined that the heat sealed edge will be the same edge used for inspection, add another 2 inches for a future heat seal (total of 5 inches).
2. Fold material over onto itself.
3. Heat seal two edges, leaving one edge open for product insertion.

2.2.5 Product Loading/Barrier Bag Sealing Procedure

1. Select appropriate size bag for product(s). Product(s) should fit comfortably into bag and not stretch or strain the bag material, cause lumps, or press against outer surface. The bag should be sized with sufficient barrier material area at the bag opening (5 inches) to permit initial sealing plus one additional seal, which is required for inspection of the product during the storage period. Refer to subhead 2.2.4 for sizing barrier material to product dimensions.
2. Prior to placing product in bag, affix pressure sensitive labels to outer surface of the bag (as required).
   a. A bar code label (A-PS-3628231-0-0) is recommended for product identification. In the absence of a bar code label, any self-adhesive label may be used. This label must include the date that the package was sealed (as a minimum).
   b. A long-term storage label (A-PS-3632006-0-0) should be affixed to a prominent place on the bag, as a precaution against premature opening.
3. Place component parts inside bag. Parts may be in original container(s).

NOTE

It is recommended that sharp edges or points of static-sensitive components not be in direct contact with the inside surface of the barrier material.

2.2.5 Product Loading/Barrier Bag Sealing Procedure (continued)

4. Determine the proper amount of desiccant (refer to heading 3).
5. Place desiccant within the barrier bag, and ensure that the desiccant does not come into direct contact with the product being protected.

CAUTION:

Due to the moisture adsorbing properties of the desiccant and humidity indicator card, pre-exposure to air should be minimized. The storage container must not be opened for longer than required for withdrawals. Withdrawals must be limited to the quantity intended for immediate use and the container immediately and tightly resealed.

Components such as integrated circuits that are prepacked in antistatic open ended tubes or other open ended carriers may be sealed within the bag providing the packaging material conforms to Federal Test Method 101C, *Contact Corrosivity Test of Solid Materials in Flexible, Rigid, or Granular Forms*.

6. Position the Humidity Indicator as far from the desiccant and as close to the bag opening as possible.
7. Refer to Figure 1. Place the open end of the bag over the two oval-shaped tubes that protrude from between the sealing jaws (the bag should extend one inch inside the jaws). Hold the bag edges taut during sealing operation to minimize wrinkling.
8. Depress the foot switch until the Seal Cycle begins (red bulb lights).
9. Release the foot switch. The sealing jaws will close, air will be evacuated from the bag, and a nitrogen atmosphere created.

   The sealing jaws will automatically open when sealing is completed.

Figure 1: PAC Vacuum Bag Impulse Sealer

2.3 AIR EVACUATION PROCESS

In the Air Evacuation process, the item to be protected is enclosed with activated desiccant in a barrier material where the enclosed air volume is reduced to a practical minimum prior to heat sealing. The desiccant requirements for this method are greater than for the Nitrogen Flush process (see subhead 2.2), since the desiccant must dry out the initial atmosphere within the barrier at the time of sealing.

2.3.1 Materials and Equipment

- MATERIALS
  - **a.** Barrier material (bag) conforming to MIL-B-81705, *Type I Barrier Material, Flexible, Electrostatic-free, Heat-sealable*. The water vapor transmission rate (WVTR) of these bags is less than 0.02 grams/100 square inches/24 hours at 38 C (100 F) 90% RH. For a general description of bag material and construction, refer to Digital specification A-PS-1200060-GS, *Barrier Bag, Antistatic, General Specification For*.
  - **b.** Desiccant conforming to MIL-D-3464, *Desiccants, Activated, Bagged, Packaging Use, and Static Dehumidification - Type II, Non-dusting*, in proper amounts based on the surface area of the barrier material and other factors as outlined under heading 3. Refer to Digital specification A-PS-9906086-00, *Desiccant* for more information.
  - **c.** Humidity Indicator Card, conforming to MS-20003-2, *Indicator, Humidity, Card, Three-spot Impregnated Areas (Cobaltous Chloride)*. Indicator spots shall be located 30% RH, 40% RH, and 50% RH. Refer to Digital specification A-PS-9908554-00, *Indicator, Humidity* for more information.
  - **d.** Digital specification number A-PS-3632006-0-0, *Label, Long-Term Storage, ESD*. This label identifies the package as containing desiccant (a method of moisture control), and is used to caution against chance opening of the bag.
  - **e.** Identification label. Use bar code label A-PS-3628231-0-0, *Label, Direct Thermal* (per EL-CP047-01, *Bar Code Label Print Specification*) when possible.
- EQUIPMENT
  - **a.** Power supply - 110/120 AC 60 hertz, single phase.
  - **b.** Vacuum producing device. A standard home vacuum (hand held is preferable) will meet the need.
  - **c.** Heat sealer - portable sealer. Vertrod, Model 12H-5/16 (12 inch clamping jaws with a 5/16 inch wide seal) or equivalent.
  - **d.** Work table grounded according to *DEC STD 067-0 Handling of Electrostatic-sensitive Devices - Procedures and Protective Materials*.

2.3.2 Space Requirements

- **a.** Heat sealer - portable
- **b.** Vacuum device - portable
- **c.** Bag material storage area - as required
- **d.** Work Table - 2 feet wide x 3 feet long x 3 feet high
- **e.** Work area - approximately 8 feet x 8 feet

2.3.3 Sealing Procedure

1. Select appropriate size bag for product(s). Product(s) should fit comfortably into the bag and not stretch or strain bag material, cause lumps, or press against outer surface. The bag should be sized with enough barrier material (approximately 5 inches) at the bag edge normally opened for inspection to allow for at least one subsequent seal. Refer to subhead 2.2.4 when proper size bags are not available.
2. Prior to placing product, affix pressure-sensitive labels to the outer surface of the bag (as required).
   a. A bar code label (A-PS-3628231-0-0) is recommended for product identification. In the absence of a bar code label, any self-adhesive label may be used. This label must include the date that the package was sealed (as a minimum).
   b. A long-term storage Label (A-PS-36320006-0-0) should be affixed to a prominent place on the bag, as a precaution against premature opening.
3. Place component parts inside bag (parts may or may not be in original container). Sufficient cushioning must be provided to prevent the item from puncturing the barrier material during air evacuation, which would reduce the barrier's water/vapor protection.

NOTE

It is recommended that sharp edges or points of static-sensitive components not be in direct contact with the inside surface of the barrier materials.

4. Determine the proper amount of desiccant (refer to heading 3).
5. Place desiccant within the barrier bag and ensure that the desiccant does not come into direct contact with the product being protected.

CAUTION:

Due to the moisture adsorbing properties of the desiccant, pre-exposure to air should be minimized. The desiccant storage container must not be opened for any longer period than is absolutely necessary for withdrawals. Withdrawals must be limited to the quantity intended for immediate use and the container tightly sealed immediately thereafter.

Components such as integrated circuits that are prepacked in antistatic open ended tubes or other open ended carriers may be sealed within the bag, providing the packaging material conforms to Federal Test Method 101C, *Contact Corrosivity Test of Solid Materials in Flexible, Rigid, or Granular Forms*.

6. Position the Humidity Indicator inside the bag, as far from the desiccant and as close to the bag opening as possible.

2.3.3 Sealing Procedure (continued)

7. Seal the bag opening to the point of air evacuation, leaving room for the vacuum nozzle to enter the bag. Insert nozzle, turn vacuum device to exhaust, hold slack material around nozzle, and evacuate the air.

   Draw sufficient vacuum for the bag to cling snugly to the enclosed item. Ensure that an excessive amount of vacuum is not drawn, as this may puncture or rupture the barrier. (A rule of thumb: Sufficient air has been evacuated when a minimum of 1 inch of barrier material can be pulled away from the product.)

   Note that proper evacuation is critical when sealing disk drives, head disk assemblies, and similar parts. Excessive air evacuation (negative pressure) can rupture the seals/gaskets of the head disk assembly and contaminate the media.

8. Heat seal final opening before removing air evacuation nozzle. Hold the bag edges taut during sealing operation to minimize wrinkling.

3 DESICCANT REQUIREMENTS

To effectively safeguard the contents of a package against corrosion during storage, it is necessary to maintain a moisture controlled environment within the barrier bag (average of 30% RH with a maximum of 40% RH). Sufficient desiccant is needed to adsorb the initial moisture within the barrier material at the time it is sealed, and to continually adsorb water vapor as it permeates the material throughout the storage period.

NOTE

A unit of desiccant is defined as that quantity of desiccant that in equilibrium at 25 C adsorbs 3.0 grams of moisture at 20% RH and 6.0 grams of moisture at 40% RH. The approximate weight of one unit of silica gel desiccant is 1 ounce (28 grams); the approximate weight of one unit of activated clay is 1.1 ounces (32 grams).

To compute the number of desiccant units required to maintain 40% RH or less within the sealed barrier requires a knowledge of:

- **The surface area and Water Vapor Transmission Rate (WVTR) of the barrier material**
- **Minimum amount of moisture adsorbed by each unit of desiccant**
- **Dunnage sealed within the barrier**
- **Storage time**
- **Temperature/RH and resulting dew-point, within the storage location**

3.1 FORMULA FOR CALCULATING DESICCANT REQUIREMENTS

$$U = (F\ A\ C1\ T) + (8\ D\ C2)$$

Where:

U	=	Number of desiccant units required
A	=	Area of barrier material (given in square inches or square centimeters)
F	=	Factor related to annual dew point in regions as defined in Table 1
T	=	Estimated storage time (months) from time of sealing One year (12 months) is considered normal when storage time is unknown— when explicit time is known, the time factor (number of months) should be used in the calculations.
D	=	Weight (Mass) of cellulosic dunnage (product packaging material), that is, wood or paper, that will be sealed within the barrier
C1	=	.01 when the barrier material area [A] is given in square inches .00155 when the barrier material area [A] is given in metric
C2	=	1.0 when the dunnage [D] weight is given in pounds .0022 when the dunnage [D] mass (weight) is given in grams

Notes to Desiccant Formula:

1. The Nitrogen Flush process replaces moisture laden air contained within the barrier bag with dry nitrogen at the time it is sealed; the Air Evacuation process does not. Therefore, when using the Air Evacuation process it is suggested that the desiccant units be increased by 10% to remove any residual moisture trapped within the bag prior to sealing.
2. WVTR for the barrier materials used in both processes is 0.02 grams/100 square inch/24 hours at 100 degrees C, 90% RH. Since climatic conditions within most Digital storage facilities are not that severe, a table is provided to approximate the rate of transmission relative to the estimated average dew points for certain regions around the world (see Table 1). For regions not listed, or if there is a question of what the average dew point is within a region, contact the local weather station.
3. Even when conditions within a storage facility are controlled, it is important to know the average dew point within that facility regardless of the region. Dew points and "F" factors from Table 1 still apply.

Table 1: Average Dew Points (± 2) from Selected Regions

Region		Dew Point	Multiplier "F" factor
1	Undefined	96	.1012
2	Undefined	80	.0604
3	Undefined	75	.0508
4	San Juan, Puerto Rico	70	.0433
5	Taipei, Taiwan Honululu, Hawaii Canton, China	65	.0354
6	New Orleans, Louisiana	60	.0304
7	Austin, Texas	55	.0250
8	Los Angeles, California Greenville, South Carolina Shannon, Ireland	50	.0208
9	San Francisco, California Seattle, Washington	45	.0166
10	Phoenix, Arizona Boston, Massachusetts Chicago, Illinois	40	.0137
11	Portland, Maine Burlington, Vermont Concord, New Hampshire Tucson, Arizona Minneapolis, Minnesota	35	.0112
12	Albuquerque, New Mexico Colorado Springs, Colorado	<30	.009

3.2 EXAMPLES FOR DETERMINING DESICCANT REQUIREMENTS

Determine the amount of desiccant required to protect a standard module [HEX, prepackaged in a shipping container, corrugated pack material weighing 84 grams (0.19 pounds)] for two years storage in an uncontrolled environment within region 10, using the Nitrogen Flush process.

The packaged module measures 41.6 x 30.5 x 1.6 cm (16 x 12 x 5/8 inch), requiring a barrier bag size of 32.1 x 54.9 cm (12.625 x 21.625 inches). It has been determined that the RH inside the barrier bag should not exceed 40% throughout the storage period.

EQUATION:

$$U = (F\ A\ C1\ T) + (8\ D\ C2)$$

Example A (Using U.S. Measurements)

Variables:

F	=	.0137 (Region 10 from Table 1)
A	=	546 Sq. In. (2 x [12.625 inch x 21.625 inch])
C1	=	.01
T	=	24 months (2 years)
D	=	.19 lbs
C2	=	1.0

Solution:

$$U = (.0137\ X\ 546\ X\ .01\ X\ 24) + (8\ X\ .19\ X\ 1.0)$$

```
.0137 x 546 x .01 x 24 = 1.795
       + 8 x .19 x 1.0 = 1.520
                         -------
                          3.315 desiccant units required (round off to 3)
```

Note: If the Air Evacuation process is used instead of the the Nitrogen Flush, the desiccant requirements would be increased 10%, that is, 3.273 + 0.327 = 3.600 (round off to 4 desiccant units).

3.2 EXAMPLES FOR DETERMINING DESICCANT REQUIREMENTS (continued)

Example B (Using Metric Measurements)

Variables:

F	=	.0137 (Region 10 from Table 1)
A	=	3524 Sq Cm. (2 x [32.1 cm x 54.9 cm])
C1	=	.00155
T	=	24 months (2 years)
D	=	84 gm
C2	=	.0022

Solution:

$$U = (.0137 \text{ X } 3524 \text{ X } .00155 \text{ X } 24) + (8 \text{ X } 84 \text{ X } .0022)$$

```
.0137 x 3524 x .00155 x 24 = 1.795
         + 8 x 84 x .0022  = 1.478
                            -------
                             3.273 units of desiccant required (round off to 3)
```

Note: If the Air Evacuation process is used instead of the the Nitrogen Flush, the desiccant requirements would be increased 10%, that is, 3.273 + 0.327 = 3.600 (round off to 4 desiccant units).

4 STORAGE

4.1 MONITORING

It is the responsibility of the equipment owner to define a system for monitoring the effectiveness of the process over extended periods of time. It is suggested that, at a minimum, the protected package be dated at the time of sealing and that random packages be opened at predetermined times to check the Humidity Indicator Card for the presence of moisture.

4.2 HUMIDITY INDICATOR CARD

Humidity Indicator Cards are included as a check on the condition within the dehumidified package. Indicators conforming to Digital specification A-PS-9908554-00 are constructed of blotting paper on which three humidity sensitive areas are visible. The three areas are normally blue in color but turn pink when RH exceeds the following predetermined levels ($\pm$ 5%).

a. Bottom dot - 30% RH: This is the first warning that the humidity level within the barrier is rising. From this point on, packages with the same date should be closely monitored.

b. Middle dot - 40% RH: This is the signal to open other packages with the same date or older and replace spent desiccant with fresh units if storage is to continue.

c. Top dot - 50% RH: If this dot is pink, other packages with the same date or older should be opened and the devices checked for signs of moisture damage. If damage is not evident, repack with fresh desiccant units to continue storage protection.

4.3 OPENING STORED PRODUCT

Observe the following rules when opening bags containing stored product.

a. When the bagged product is suspected of being sensitive to ESD, the operator shall be grounded or use grounded scissors. Allow three minutes from the time the bag is opened before removing product from the storage bag. This enables the bag material surfaces to regain moisture, reducing tribo-charge generation.

b. Desiccant and humidity indicators shall not be reused.

5 RECOMMENDED MATERIAL/EQUIPMENT SUPPLIERS

Process equipment can be ordered from the following suppliers. Note that the following sources are recommendations only; there may be other qualified suppliers who can provide the same equipment and materials.

a. Richmond RCAS 3750 Barrier Bags [1] [2]

New England states	The Rourke-Eno Paper Company, Inc. 485 Wildwood St. Woburn, MA 01801 (617) 938-7600
Central, Western, and Southern states	Richmond Technology, Inc. P.O. Box 1129 Colton & Opal Avenues Redlands, CA 92373 (213) 628-8263 (714) 794-2111 TELEX: 67-6460

b. Laminated Film's LF-6030 Barrier Bags

The Rourke-Eno Paper Company, Inc.

or

Laminated Films and Packaging, Inc.
3560 Lafayette Road
Portsmouth, N.H. 03801
(603) 436-6374
(617) 938-7600

c. Impulse Sealer, "PAC" Vacuum Bag Sealer Series V. [1]

Distributor:	Audion Elektro P.O. Box 289 1380 A.G. Weesp Holland Tel: (2940) 80855 TELEX: 13410 Fax: 0-2940 19770
May be ordered from:	
New England states	The Rourke-Eno Paper Company, Inc. (address listed above)
Central, Western, and Southern states	Packaging Aids Corporation P.O. Box 9144 24 Tiburon Street San Rafael, CA 94901 (415) 454-4868 TELEX: 340-598

d. Two stage Nitrogen Gas Regulator, Bottled Nitrogen, and Gas Cylinder Safety bracket. [1]

Available from any industrial gas supplier. Refer to local yellow pages under "Industrial Gases".

e. Heat Sealer - Vertrod model 12H-5/16 [2]

May be ordered from:

Vertrod
2037 Utica Avenue
Brooklyn, NY 11234
Tel: (212) 241-8080

f. MIL-B-81705, *Type I, Barrier Material, Flexible, Electrostatic-Free, Heat Sealable* (Digital specification number 1200060-GS) [2]

g. MS20003 Humidity Indicator Card (Digital specification number 9908554-00) [1] [2]

h. MIL-D3464, *Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification - Type II - Non-dusting* (Digital specification number 9906086-00) [1] [2]

Items f, g, and h may be ordered from:

Lawrence Packaging Supply Corp.
113 North 13th Street
Newark, NJ 07107
Tel: (201) 485-4400
Sales offices throughout the United States

Footnotes:

[1] Required for use with Nitrogen process.
[2] Required for use with the Air Evacuation process.

APPENDIX A

REFERENCED DOCUMENTS

A.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00067-00	*DEC STD 067-0 Handling of Electrostatic-sensitive Devices - Procedures and Protective Materials*
EL-00102-01	*DEC STD 102-1 Environmental Standard for Computers and Peripherals - Temperature, Humidity, and Altitude Test Requirements*
EL-CP047-01	*Bar Code Label Print Specification*

Use VTX SMC to order copies of EL-class documents from Standards and Methods Control. Send distribution questions to JOKUR::SMC or call DTN: 234-4423.

A.2 Digital Specifications

Specification Number	Document Title
A-PS-1200060-GS	*Barrier Bag, Antistatic, General Specification For*
A-PS-3632006-0-0	*Label, Long-Term Storage, ESD*
A-PS-3628231-0-0	*Label, Direct Thermal*
A-PS-9906086-00	*Desiccant*
A-PS-9908554-00	*Indicator, Humidity*

Copies of Digital specifications may be obtained from: Central Specification Control Systems, NRO-5/M2, any Microfilm Reference File, or the SPOC system.

A.3 Federal Documents

Number	Document Title
Federal Test Method 101C	*Contact Corrosivity Test of Solid Materials in Flexible, Rigid, or Granular Forms*
MIL-D-3464	*Desiccants, Activated, Bagged, Packaging Use, and Static Dehumidification - Type II, Non-dusting*
MIL-B-81705	*Type I Barrier Material, Flexible, Electrostatic-free, Heat-sealable*
MS2003-2	*Indicator, Humidity, Card, Three-spot Impregnated Areas (Cobaltous Chloride)*

The above document is available from the Naval Publications and Forms Office, 5801 Tabor Avenue, Philadelphia, PA 19120.

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